

Y-12 PLANT GROUNDWATER PROTECTION PROGRAM
GROUNDWATER AND SURFACE WATER
SAMPLING AND ANALYSIS PLAN
FOR CALENDAR YEAR 2001

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Prepared by

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Environment, Safety, and Health Organization
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831

Managed by

LOCKHEED MARTIN ENERGY SYSTEMS, INC.
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List of Acronyms and Abbreviations

ACO	Analytical Chemistry Organization
Bear Creek Regime	Bear Creek Hydrogeologic Regime
Chestnut Ridge Regime	Chestnut Ridge Hydrogeologic Regime
CY	Calendar Year
DOE	U.S. Department of Energy
East Fork Regime	Upper East Fork Poplar Creek Hydrogeologic Regime
GWPP	Groundwater Protection Program
LMES	Lockheed Martin Energy Systems, Inc.

1.0 INTRODUCTION

This plan provides a description of the groundwater and surface water quality monitoring activities planned for calendar year (CY) 2001 at the U.S. Department of Energy (DOE) Y-12 Plant that will be managed by the Y-12 Plant Groundwater Protection Program (GWPP). Groundwater and surface water monitoring performed by the Y-12 Plant GWPP during CY 2001 will be in accordance with the following requirements of DOE Order 5400.1:

- ! to evaluate and maintain surveillance of existing and potential groundwater contamination sources;
- ! to provide for the early detection of groundwater contamination and determine the quality of groundwater and surface water where contaminants are most likely to migrate beyond the Oak Ridge Reservation property line;
- ! to identify and characterize long-term trends in groundwater quality at the Y-12 Plant; and
- ! to provide data to support decisions concerning land disposal practices and the management and protection of groundwater resources.

Groundwater and surface water monitoring during CY 2001 will be performed in three hydrogeologic regimes at the Y-12 Plant: the Bear Creek Hydrogeologic Regime (Bear Creek Regime), the Upper East Fork Poplar Creek Hydrogeologic Regime (East Fork Regime), and the Chestnut Ridge Hydrogeologic Regime (Chestnut Ridge Regime). The Bear Creek and East Fork regimes are located in Bear Creek Valley, and the Chestnut Ridge Regime is located south of the Y-12 Plant (Figure 1). Additional surface water monitoring will be performed north of Pine Ridge, along the boundary of the Oak Ridge Reservation (Figure 1).

Modifications to the CY 2001 monitoring program may be necessary during implementation. Changes in programmatic requirements may alter the analytes specified for selected monitoring wells, or wells could be added or removed from the planned monitoring network. All modifications to the monitoring program will be approved by the Y-12 Plant GWPP manager and documented as addenda to this sampling and analysis plan.

2.0 MONITORING LOCATIONS

The Y-12 Plant GWPP monitoring network for CY 2001 includes 91 monitoring locations. Groundwater samples will be collected from a total of 66 monitoring wells, including 26 wells located in the Bear Creek Regime (Figure 2), 10 wells located in the Chestnut Ridge Regime (Figure 3), and 30 wells (one well has 10 discreet sampling points) located in the East Fork Regime (Figure 4). Samples of groundwater discharging from nine natural springs also will be collected, including three springs (SS-1, SS-4, and SS-5) in the Bear Creek Regime (Figure 2) and six springs (SCR2.1SP, SCR2.2SP, SCR3.4SP, SCR5.1SP, SCR5.2SP, and SCR5.4SP) in the Chestnut Ridge Regime (Figure 3). Surface water samples will be collected from 16 sampling locations during CY 2001, including seven locations in the Bear Creek Regime, three locations in the Chestnut Ridge Regime, one location in the East Fork Regime, and five locations north of Pine Ridge. In the Bear Creek Regime, samples will be collected from Bear Creek at six sampling stations located from about 0.6 to 12 kilometers upstream of the confluence of Bear Creek and East Fork Poplar Creek (BCK-00.63 to BCK-11.97), and from one sampling station along a northern tributary (NT-01) to Bear Creek (Figure 2). Samples will be collected from three unnamed tributaries at stations along the north side of Bethel Valley Road (SCR1.5SW, SCR2.2SW, and SCR4.4SW) in the Chestnut Ridge Regime (Figure 3). In the East Fork Regime, samples will be collected from the outfall of the New Hope Pond distribution channel at Lake Reality Emergency Spillway (Figure 4). The locations north of Pine Ridge include samples collected from three tributaries (NPR07.0SW, NPR10.0SW, and NPR12.0SW) near the Scarboro Community and two tributaries (GHK2.51ESW and GHK2.51WSW) near Country Club Estates (Figure 5).

3.0 SAMPLE COLLECTION AND HANDLING

Monitoring wells, springs, and surface water stations are subdivided into sample groups based on hydrogeologic regimes. These sample groups will be sampled in the sequence shown on Table 1 and are designated by sampling location: BC (Bear Creek Regime), CR (Chestnut Ridge Regime), EF (East Fork Regime), and PR (north of Pine Ridge). The sampling sequence is generally from least contaminated to most contaminated location within each sampling group.

Personnel from the Y-12 Plant Analytical Chemistry Organization (ACO) will be responsible for collection, transportation, and chain-of-custody control of the groundwater and surface water samples. Sampling will be performed in accordance with the most recent version of Y-12 Plant Procedures for obtaining groundwater samples (Lockheed Martin Energy Systems, Inc. [LMES] 1999a, 2000a, 2000b), surface water samples (LMES 1999b), and field measurements (LMES 1996, 1999c, and 1999d). All field and laboratory activities will be performed in accordance with applicable requirements of the Y-12 Plant Integrated Safety Management System.

Groundwater samples will be collected from monitoring wells using bladder pumps unless a well is equipped with a Westbay™ multiport sampling system (Table 1). Typically, a bladder pump is permanently installed in each well that is scheduled for sample collection. If well construction prevents permanent installation (e.g., flush-mounted wells), then the pump and tubing will be installed at least 24 hours before sample collection and will be removed when sampling is completed. During CY 2001, the low-flow minimal drawdown purging and sampling method (low-flow method) will be used to collect groundwater samples from all wells that do not have a Westbay multiport sampling system. In accordance with the procedure for the low-flow method (LMES 1999a), groundwater samples will be collected from the well immediately following the stabilization (minimal variation over four consecutive readings) of field measurements (pH, conductivity, temperature, oxidation-reduction potential, and dissolved oxygen) of the groundwater purged from the well at a low flow rate (<300 milliliters per minute) which ensures minimal drawdown of the water level in the well (<0.1 foot per 15 minutes). Using this sampling method, representative groundwater samples are obtained without the influence of stagnant water in the well.

Groundwater sampling using a Westbay™ multiport sampling system at well GW-722 in the East Fork Regime will be performed in accordance with the most recent and approved operating procedures (LMES 2000a and 2000b). The groundwater samples from each sampling port will be collected in 250-milliliter nonvented stainless steel Westbay™ sample collection bottles filled at the designated depth in the well by opening the sampling port valve. Once filled, the bottle is raised to the surface and the sample is transferred to laboratory sample containers. Normally, a Westbay™ sample collection bottle will be filled about seven times at each port to obtain enough groundwater to fill all of the laboratory sample bottles. The first sample bottle is used as a “formation rinse” to obtain field measurements and condition the sample bottle for each particular zone.

Unfiltered samples will be collected semiannually from all of the monitoring wells, springs, and surface water stations during CY 2001. As summarized below, the number of samples to be collected during each quarter will range from 35 to 65, for an annual total of 200 samples.

HYDROGEOLOGIC REGIME/AREA	NUMBER OF SAMPLES PER QUARTER OF CY 2001	
	1st and 3rd	2nd and 4th
Bear Creek Regime	36	0
Chestnut Ridge Regime	19	0
East Fork Regime	10	30
North of Pine Ridge	0	5
TOTAL:	65	35

In addition to the groundwater and surface water samples, field blanks and equipment rinsate samples will be collected at the frequencies and analyzed for the parameters specified on Table 1. Field blank samples will be collected from at least 10% of the sample groups. A field blank will be collected during each quarter of CY 2001: at BC-2 during the first and third quarters and at EF-2 during the second and fourth quarters. Equipment rinsate samples will be collected from well GW-722 (EF-WB) and from the wells with portable sampling equipment (Table 1). The rinsate sample will be obtained in the field immediately after field-cleaning the sampling equipment used to collect samples from the last sampling port (GW-722-17) or the last well sampled with a particular pump.

Trip blank samples, field duplicate samples, and laboratory quality assurance samples will be prepared and analyzed as specified in the ACO Laboratory Quality Assurance Project Plan (Martin Marietta Energy Systems, Inc. 1991) using applicable analytical procedures. The location (building and room number) where the trip blank samples are prepared will be recorded on the field data sheets. Trip blank samples will be prepared for each cooler used to transport samples for volatile organic analyses. Duplicate samples will be collected from at least 10% of the sampling locations. A total of 24 field duplicate samples will be collected during CY 2001, including eight in the Bear Creek Regime, four in the Chestnut Ridge Regime, 10 in the East Fork Regime, and two from surface water stations located north of Pine Ridge (Table 1).

4.0 FIELD MEASUREMENTS AND ANALYTICAL PARAMETERS

Field personnel will measure the depth to water before purging and sampling groundwater in each monitoring well. Sampling personnel also will record field measurements of pH, temperature, conductivity, dissolved oxygen, and oxidation-reduction potential before collecting samples at each monitoring location (Table 2).

For this Sampling and Analysis Plan, specific analytes are grouped by analytical method or by type (e.g., trace metals) and referenced as analytical parameters. In addition to field measurements, all groundwater and surface water samples will be analyzed for the following suite of parameters (identified as the Standard Administrative Parameter Group):

- ! miscellaneous laboratory analytes - pH, conductivity, turbidity, total suspended solids, and total dissolved solids;
- ! major anions;
- ! trace metals (includes major cations);
- ! a comprehensive suite of organic compounds; and
- ! gross alpha and gross beta activity.

In addition to the analytes included in the Standard Administrative Parameter Group, samples from selected locations will be analyzed for specific radionuclides (Table 1). The results for the principal alpha- and beta-emitting isotopes (as determined from historical monitoring results) will be used to verify that gross alpha and gross beta activities are appropriate values for evaluating long-term trends in groundwater and surface water quality.

5.0 REFERENCES

- Martin Marietta Energy Systems, Inc. 1991. *Laboratory Quality Assurance Project Plan for the Sampling and Analysis of Groundwater Wells at the Y-12 Plant Site on the Oak Ridge Reservation*. Prepared by Analytical Chemistry Department Technical Division, QAP: 04-90-0014.
- Lockheed Martin Energy Systems, Inc. 1996. *Redox Meter Calibration and Operation*. Prepared by the Analytical Services Organization (SESD-TP-8201, Rev. 2).
- Lockheed Martin Energy Systems, Inc. 1999a. *Groundwater Sampling*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-016).
- Lockheed Martin Energy Systems, Inc. 1999b. *Liquid Grab Sampling*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-005).
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- Lockheed Martin Energy Systems, Inc. 2000a. *Groundwater Sampling of Westbay™ Monitoring System Instrumented Wells*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-018).
- Lockheed Martin Energy Systems, Inc. 2000b. *Pressure Profiling of Wells Equipped with Westbay™ Monitoring System Instrumentation*. Oak Ridge Y-12 Plant Procedure prepared by the Environment, Safety, and Health Organization (Y50-71-019).
- U.S. Environmental Protection Agency. 1983. *Methods for Chemical Analysis of Water and Wastes*.
- U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*.

APPENDIX A

FIGURES

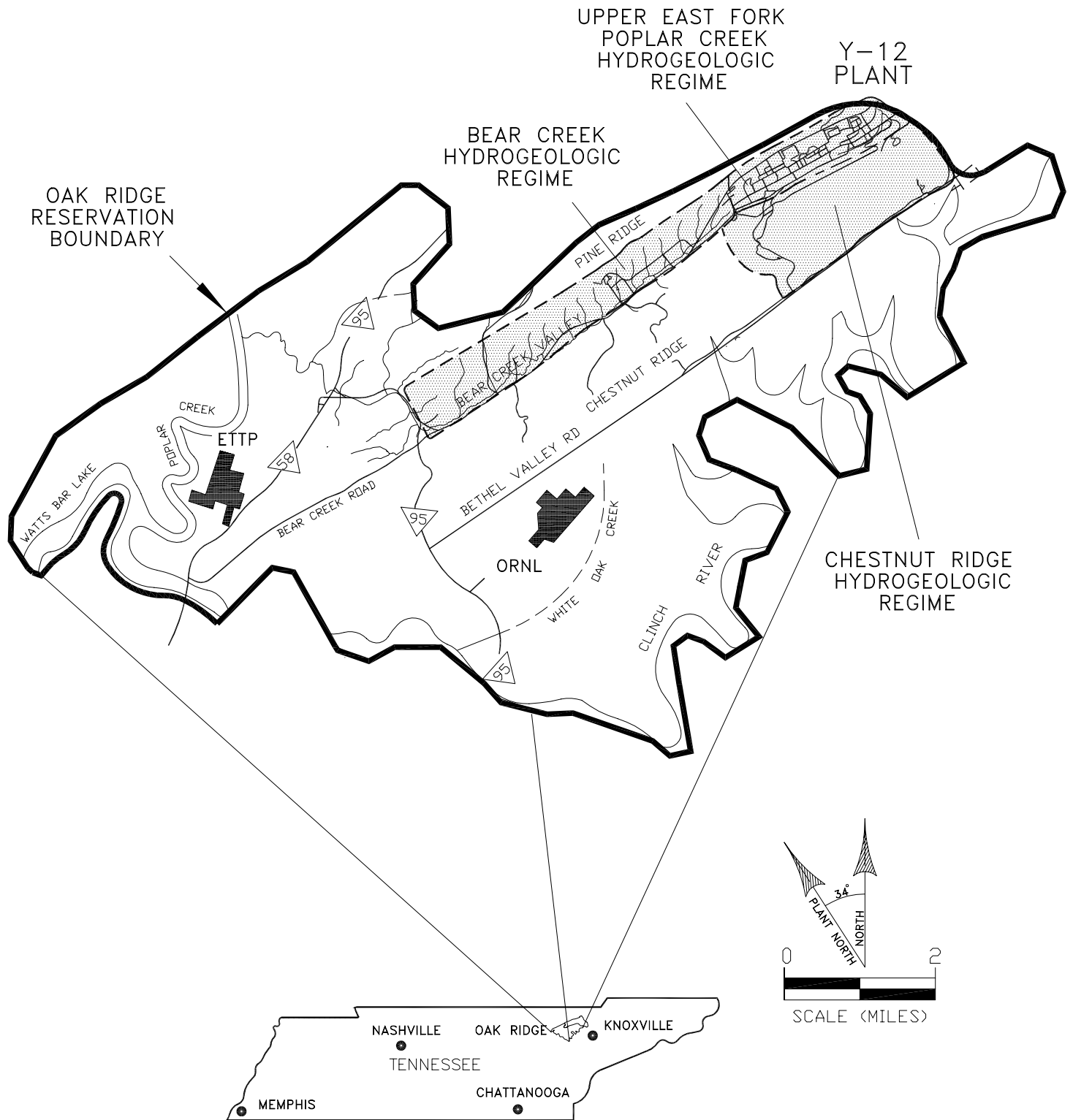
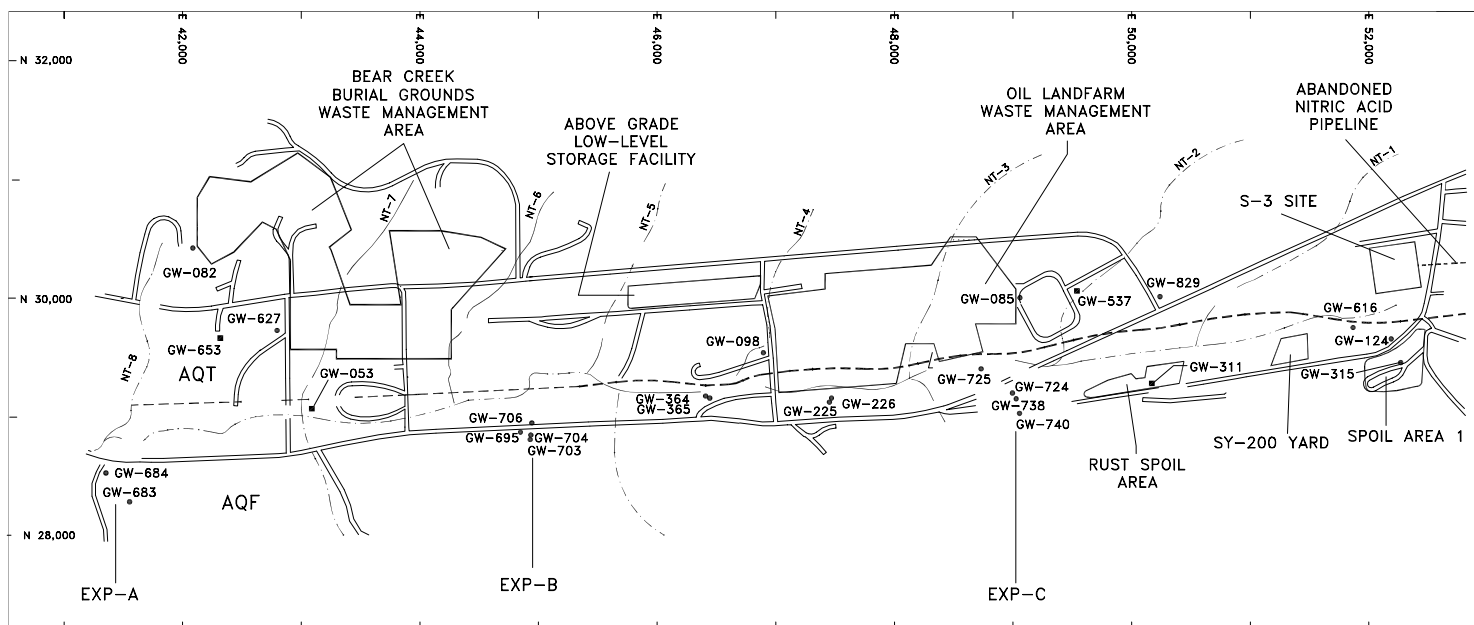
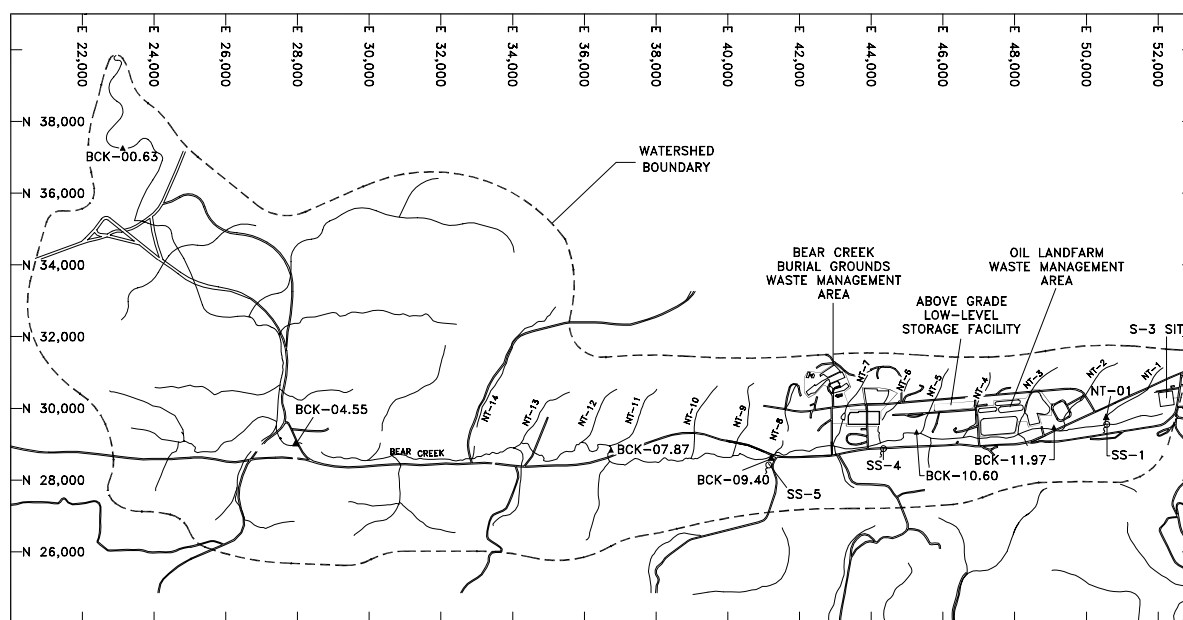


Fig. 1. Hydrogeologic regimes at the Y-12 Plant.



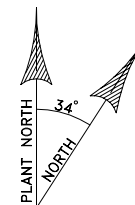
MONITORING WELL LOCATIONS



SPRINGS AND SURFACE WATER SAMPLING LOCATIONS

EXPLANATION

- — Water Table Monitoring Well
- — Bedrock Monitoring Well
- ▲ — Surface Water Sampling Station
- — Spring Sampling Station
- EXP-C — Exit Pathway, Maynardville Limestone Picket
- — Surface Drainage Feature
- NT-5 — North Tributary
- AQT — Aquitard
- — Approximate Nolichucky Shale\Maynardville Limestone Contact
- AQF — Aquifer



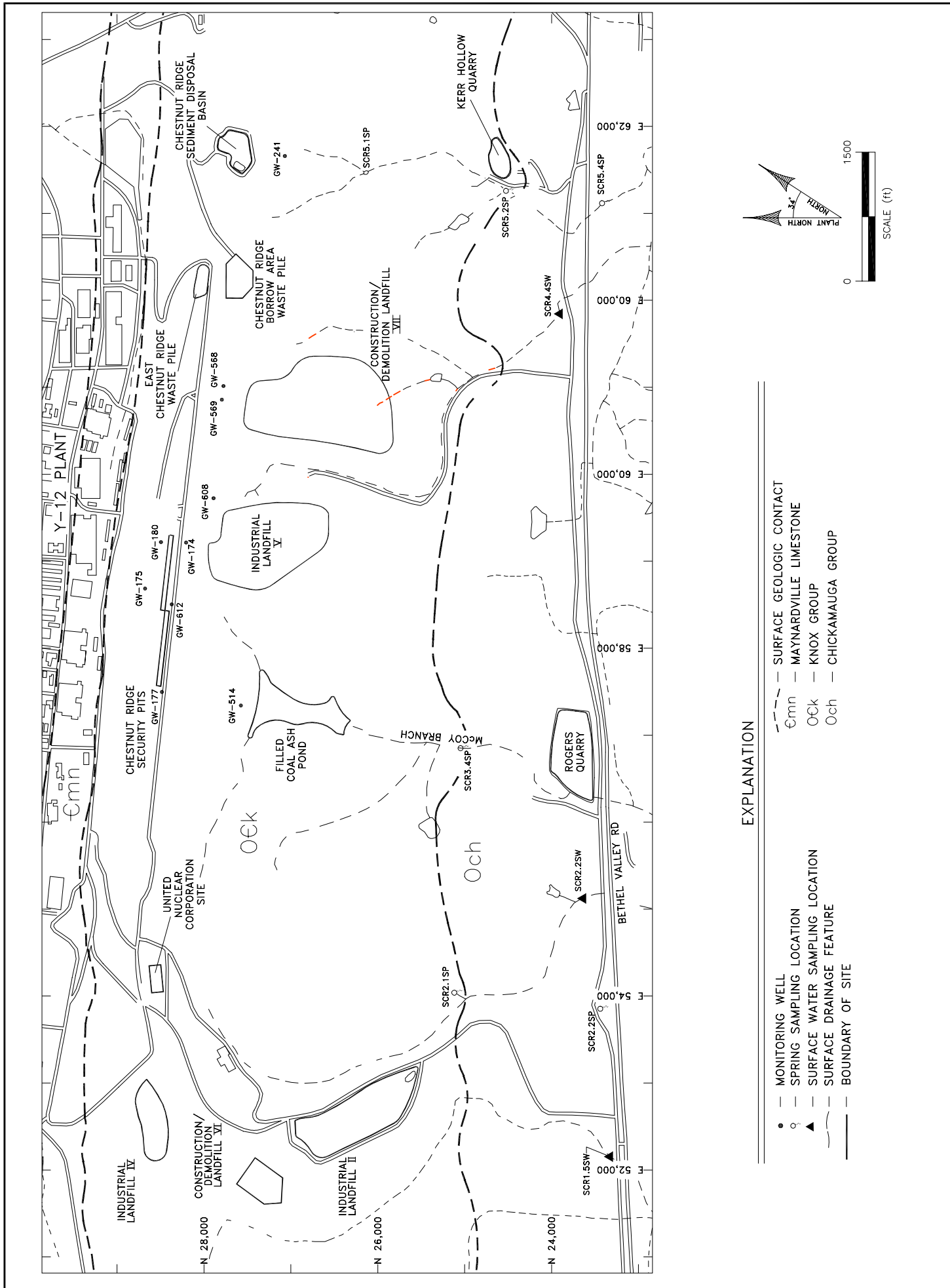
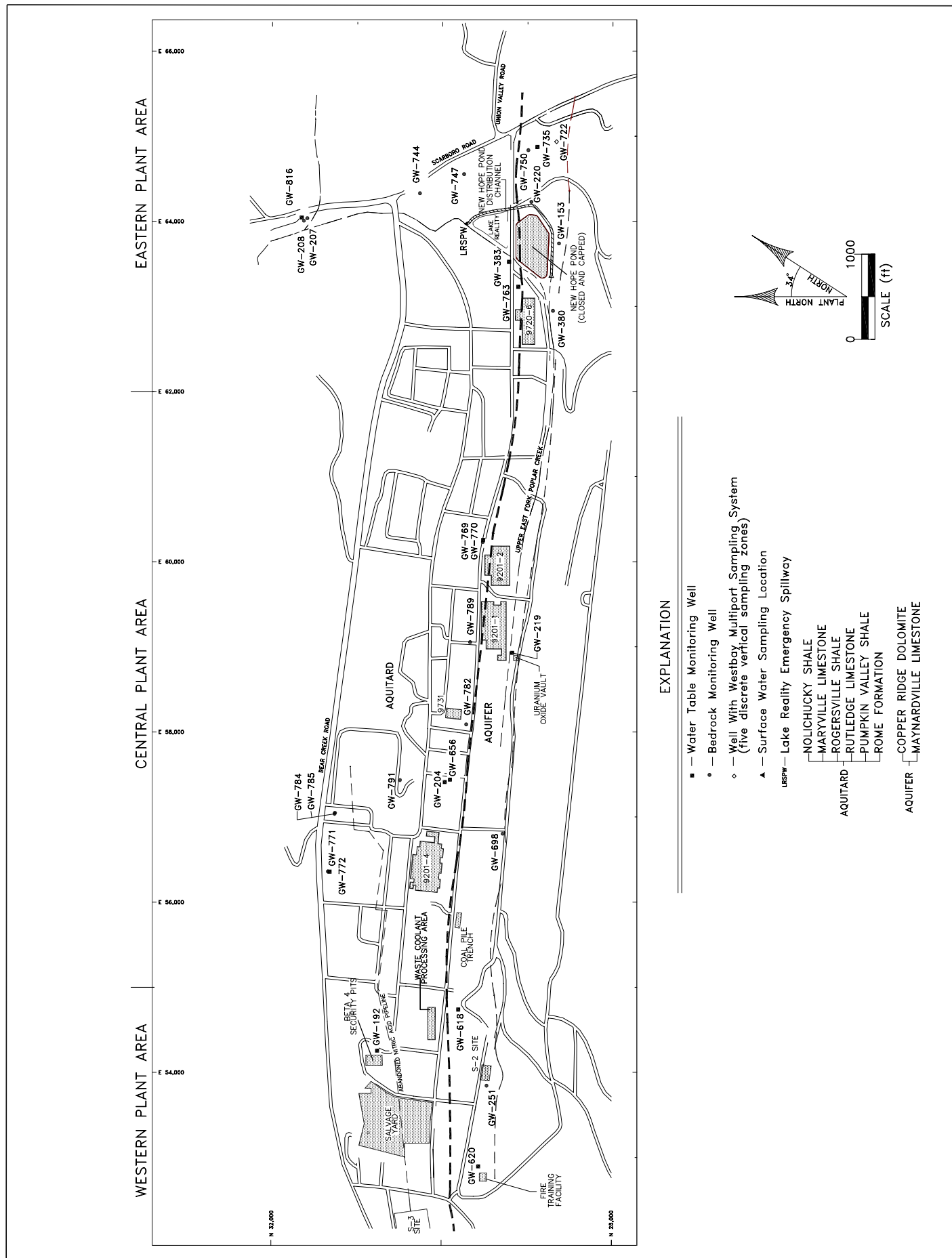
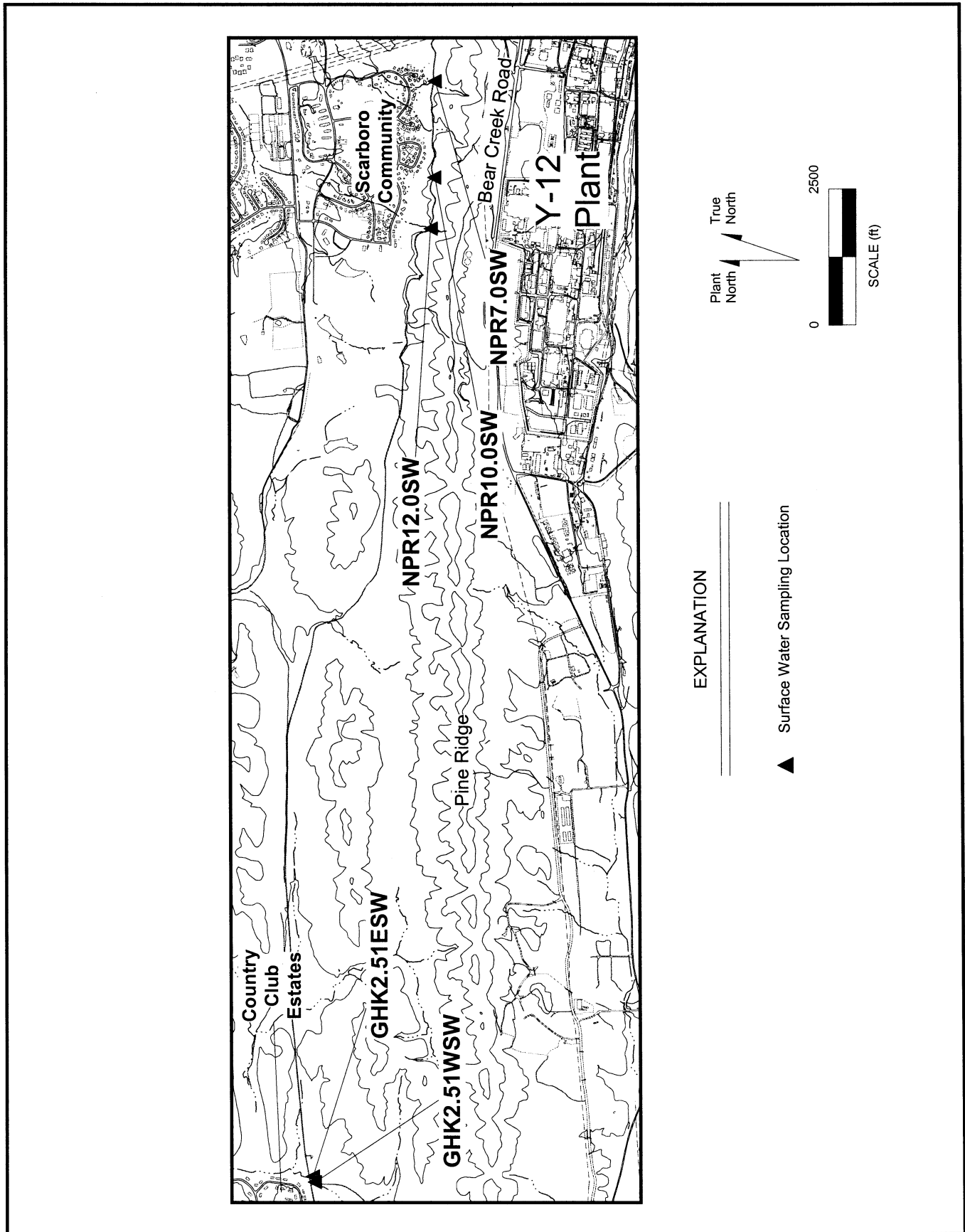


Fig. 5. CY 2001 sampling locations in the Chestnut Ridge Hydrogeologic Regime.



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Fig. 4. CY 2001 sampling locations in the Upper East Fork Poplar Creek Hydrogeologic Regime.



N_pine_r_spg.wor 9/24/1999

Fig. 5. Surface water sampling locations north of Pine Ridge, CY 2000.

APPENDIX B

TABLES

Table 1. Sampling sequence, frequency, and analytical parameters for groundwater and surface water monitoring during CY 2001

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
Bear Creek Hydrogeologic Regime						
BC-1 (Q1, Q3)	EXP-A	GW-684		Y	SMP	STD, RAD(3,12)
	EXP-A	GW-683		Y	SMP	STD, RAD(3,12)
	EXP-B	GW-695		Y	SMP	STD, RAD(3,12)
	EXP-B	GW-703		Y	SMP	STD, RAD(3,12)
	EXP-B	GW-704		Y	SMP	STD, RAD(12)
	EXP-B	GW-706	Q1	Y	SMP	STD, RAD(12)
	EXP-C	GW-740	Q3	Y	SMP	STD, RAD(3,12)
	EXP-C	GW-738		Y	SMP	STD, RAD(3,12)
	EXP-C	GW-724		Y	SMP	STD, RAD(3,12)
	EXP-C	GW-725		Y	SMP	STD, RAD(3,12)
BC-2 (Q1, Q3)	BG	GW-653			SMP	STD
	BG	GW-053		Y	SMP	STD, RAD(3,12)
	BG	GW-627		Y	SMP	STD, RAD(3)
	BG	GW-082		Y	SMP	STD
	SPI	GW-315		Y	SMP	STD
	RS	GW-311		Y	SMP	STD, RAD(3,12)
	OLF	GW-829		Y	SMP	STD, RAD(3,12)
	OLF	GW-085	Q1	Y	SMP	STD, RAD(12)
	OLF	GW-537		Y	SMP	STD, RAD(12)
	OLF	GW-226	Q3	Y	SMP	STD, RAD(3,12)
	FIELD BLANK					VOC(1)
BC-3 (Q1, Q3)	EXP-SW	BCK-00.63			EXP	STD, RAD(3,12)
	EXP-SW	BCK-04.55	Q3		EXP	STD, RAD(3,12)
	EXP-SW	BCK-07.87			EXP	STD
	EXP-SW	SS-5			EXP	STD
	EXP-SW	BCK-09.40			EXP	STD
	EXP-SW	SS-4	Q1		EXP	STD, RAD(12)

Table 1 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
BC-3 (continued) (Q1, Q3)	EXP-SW	BCK-10.60			EXP	STD, RAD(3,12)
	EXP-SW	BCK-11.97			EXP	STD, RAD(2,3,4,5,8,13)
	EXP-SW	SS-1			EXP	STD, RAD(3,12)
	EXP-SW	NT-01			EXP	STD, RAD(3,12)
BC-4 (Q1, Q3)	OLF	GW-364		Y	SMP	STD, RAD(3,12)
	OLF	GW-365	Q1	Y	SMP	STD, RAD(3,12)
	OLF	GW-098		Y	SMP	STD, RAD(3)
	OLF	GW-225	Q3	Y	SMP	STD, RAD(3,12)
	S3	GW-124		Y	SMP	STD, RAD(3,12)
	S3	GW-616		Y	SMP	STD, RAD(3,12)
	RINSATE SAMPLE					VOC(1)
Chestnut Ridge Hydrogeologic Regime						
CR-1 (Q1,Q3)	EXP-SW	SCR1.5SW			EXP	STD
	EXP-SW	SCR2.2SP			EXP	STD
	EXP-SW	SCR2.2SW			EXP	STD
	EXP-SW	SCR2.1SP	Q1		EXP	STD
	EXP-SW	SCR3.4SP	Q3		EXP	STD
	EXP-SW	SCR4.4SW			EXP	STD
	EXP-SW	SCR5.4SP			EXP	STD
	EXP-SW	SCR5.2SP			EXP	STD
	EXP-SW	SCR5.1SP			EXP	STD
CR-2 (Q1,Q3)	FCAP	GW-514			SMP	STD
	CRSDB	GW-241			SMP	STD
	CRSP	GW-568		Y	SMP	STD
	CRSP	GW-569		Y	SMP	STD
	CRSP	GW-608		Y	SMP	STD

Table 1 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
CR-2 (continued) (Q1,Q3)	CRSP	GW-175		Y	SMP	STD
	CRSP	GW-177	Q1	Y	SMP	STD
	CRSP	GW-174		Y	SMP	STD
	CRSP	GW-180	Q3	Y	SMP	STD
	CRSP	GW-612		Y	SMP	STD
	RINSATE SAMPLE					VOC(1)
Upper East Fork Poplar Creek Hydrogeologic Regime						
EF-1 (Q2,Q4)	GRID F3	GW-789			SMP	STD
	GRID G3	GW-770		Y	SMP	STD
	GRID G3	GW-769		Y	SMP	STD
	GRID E3	GW-782	Q2	Y	SMP	STD, RAD(3,4,5,8)
	GRID D2	GW-791	Q4	Y	SMP	STD
EF-2 (Q2,Q4)	B4	GW-192		Y	SMP	STD
	S2	GW-251		Y	SMP	STD
	FTE	GW-620		Y	SMP	STD
	GRID JP	GW-763	Q2	Y	SMP	STD
	NHP	GW-240		Y	SMP	STD
	NHP	GW-153		Y	SMP	STD
	NHP	GW-220		Y	SMP	STD
	NHP	GW-383	Q4	Y	SMP	STD
	NHP	GW-381		Y	SMP	STD
	FIELD BLANK					VOC(1)
EF-3 (Q2,Q4)	EXP-SW	LRSPW			EXP	STD, RAD(2,3,4,5,8)
	EXP-SR	GW-208			EXP	STD, RAD(12)
	EXP-SR	GW-207			EXP	STD, RAD(12)
	EXP-SR	GW-816	Q2		EXP	STD, RAD(12)
	GRID K1	GW-744			EXP	STD, RAD(12)
	GRID K2	GW-747			EXP	STD, RAD(12)
	EXP-J	GW-750			EXP	STD, RAD(12)
	EXP-J	GW-735	Q4		EXP	STD, RAD(12)

Table 1 (continued)

Sample Group ¹	Location ²	Sampling Point ³	Duplicate ⁴	Contain ⁵	Monitoring Driver ⁶	Parameters ⁷
EF-4 (Q2,Q4)	GRID C1	GW-771			SMP	STD, RAD(2,3,4,5,8,13)
	GRID C1	GW-772	Q2		SMP	STD, RAD(2,3,4,5,8,13)
	GRID D1	GW-784			SMP	STD, RAD(2,3,4,5,8,13)
	GRID D1	GW-785			SMP	STD, RAD(2,3,4,5,8,13)
	B8110	GW-698		Y	SMP	STD, RAD(12)
	T0134	GW-204		Y	SMP	STD, RAD(2,3,4,5,8)
	UOV	GW-219	Q4	Y	SMP	STD, RAD(3,12)
	T0134	GW-656		Y	SMP	STD, RAD(2,3,4,5,8)
EF-WB (Q1,Q3)	EXP-J	GW-722-06			EXP	STD
	EXP-J	GW-722-30			EXP	STD
	EXP-J	GW-722-26		Y	EXP	STD
	EXP-J	GW-722-32			EXP	STD
	EXP-J	GW-722-33			EXP	STD
	EXP-J	GW-722-10		Y	EXP	STD, RAD(12)
	EXP-J	GW-722-22		Y	EXP	STD, RAD(12)
	EXP-J	GW-722-20		Y	EXP	STD, RAD(12)
	EXP-J	GW-722-14	Q1	Y	EXP	STD, RAD(12)
	EXP-J	GW-722-17	Q3	Y	EXP	STD, RAD(12)
	RINSATE SAMPLE					STD
North of Pine Ridge						
PR-1 (Q2,Q4)	SCA	NPR07.0SW	Q2		SMP	STD, RAD(3)
	SCA	NPR10.0SW			SMP	STD, RAD(3)
	SCA	NPR12.0SW			SMP	STD, RAD(3)
	CCE	GHK2.51ESW	Q4		SMP	STD, RAD(3)
	CCE	GHK2.51WSW			SMP	STD, RAD(3)

Notes:

1

Samples will be collected during the calendar year quarter as specified (e.g., Q1). Surface water and spring samples in BC-3 will be collected on or about the same day as groundwater samples will be collected from wells GW-683 and GW-684 in BC-1. Samples in CR-3 will be collected about the same time as spring SCR4.3SP (coordinated with Bechtel Jacobs Company).

Table 1 (continued)

2

Bear Creek Regime

- BG - Bear Creek Burial Grounds Waste Management Area
- EXP - Exit Pathway Monitoring Location:
Maynardville Limestone Picket (-A, -B, -C)
Spring or Surface Water Location (-SW)
- OLF - Oil Landfarm Waste Management Area
- RS - Rust Spoil Area
- S3 - S-3 Site
- SPI - Spoil Area I

Chestnut Ridge Regime

- CRSDB - Chestnut Ridge Sediment Disposal Basin
- CRSP - Chestnut Ridge Security Pits
- EXP-SW - Spring or surface water sampling location
- FCAP - Filled Coal Ash Pond

East Fork Regime

- B8110 - Building 81-10
- B4 - Beta-4 Security Pits
- EXP-J - Maynardville Limestone Exit Pathway Picket J
- EXP-SR - Exit pathway well in the gap through Pine Ridge along Scarboro Road
- EXP-SW - Surface water station
- FTF - Fire Training Facility
- GRID - Comprehensive Groundwater Monitoring Plan Grid Location
- NHP - New Hope Pond
- T0134 - Underground Storage Tank 0134-U
- UOV - Uranium Oxide Vault
- S2 - S-2 Site

North of Pine Ridge

- SCA - Scarboro Community
- CCE - Country Club Estates

3

- BCK - Bear Creek Kilometer (Surface Water Sampling Station)
- GW - Groundwater Monitoring Well
- GHK - Gum Hollow Kilometer (Surface Water Sampling Station)
- LRSPW - Lake Reality Spillway (Surface Water Sampling Station)
- NPR - North Pine Ridge (Surface Water Sampling Station)
- NT - North Tributary to Bear Creek
- SCR - South Chestnut Ridge (Spring Sampling Station)
- SS - Spring Sampling Location: South Side of Bear Creek

Notes: (continued)

- 4 Q_ - Field duplicate samples will be collected at these locations during the quarter specified.
- 5 Y - All purged groundwater will be contained at these locations.
- 6 EXP - DOE Order 5400.1A Exit Pathway/Perimeter Monitoring
 SMP - DOE Order 5400.1A Surveillance Monitoring
- 7 Table 2 provides a comprehensive list of analytes and analytical methods grouped by parameter.

 STD - Standard administrative parameter group.
 See the following list of parameters that apply to CY 2000 samples.

Standard Administrative Parameter Group:

- FLD - Field measurements
- CHEM - Miscellaneous laboratory analytes (e.g., pH) and anions
- MET(1) - Metals
- VOC(1) - Volatile organic compounds
- RAD(1) - Gross alpha and gross beta

Additional Radionuclides:

- RAD(2) - Strontium-89/90, technetium-99, and tritium
- RAD(3) - Uranium-234, -235, and -238
- RAD(4) - Americium-241, iodine-129, neptunium-237, plutonium-238 and -239/240
- RAD(5) - Radium-223/224/226
- RAD(8) - Thorium-228, -230, -232, and -234
- RAD(12) - Technetium-99
- RAD(13) - Total uranium and weight percent U-235

**Table 2. Field measurements and laboratory analytes for CY 2001
groundwater and surface water samples**

FLD-Field Measurements	Analytical Method¹	Detection Limit²	Units³
Depth to Water	Y50-71-015	NA	ft
Water Temperature	Y50-71-001	NA	centigrade
pH	Y50-71-001	NA	pH units
Conductivity	Y50-71-001	NA	: mho/cm
Dissolved Oxygen	Y50-71-001	NA	ppm
Oxidation-Reduction Potential	SESD-TP-8204 (R.2)	NA	mV
CHEM - Miscellaneous Laboratory Analytes			
pH	SW846-9040	NA	pH units
Conductivity	SW846-9050	NA	: mho/cm
Total Dissolved Solids	EPA-160.1	1	mg/L
Total Suspended Solids	EPA-160.2	1	mg/L
Turbidity	EPA-180.1	0.1	NTU
CHEM - Anions			
Alkalinity - HCO ₃	EPA-310.1	1.0	mg/L
Alkalinity - CO ₃	EPA-310.1	1.0	mg/L
Chloride	EPA-300.0	0.2	mg/L
Fluoride	EPA-340.2	0.1	mg/L
Nitrate (as Nitrogen)	EPA-300.0	0.028	mg/L
Sulfate	EPA-300.0	0.25	mg/L
MET(1) - Metals/Cations			
Aluminum	SW846-6010A	0.2	mg/L
Antimony	EPA-200.8	0.0025	mg/L
Arsenic	EPA-200.8	0.005	mg/L
Barium	SW846-6010B	0.004	mg/L
Beryllium	SW846-6010B	0.0005	mg/L
Boron	SW846-6010B	0.1	mg/L
Cadmium	EPA-200.8	0.0005	mg/L
Calcium	SW846-6010B	0.2	mg/L
Chromium	EPA-200.8	0.001	mg/L
Cobalt	SW846-6010B	0.02	mg/L
Copper	SW846-6010B	0.02	mg/L
Iron	SW846-6010B	0.05	mg/L
Lead	EPA-200.8	0.0005	mg/L
Lithium	SW846-6010B	0.01	mg/L
Magnesium	SW846-6010B	0.2	mg/L
Manganese	SW846-6010B	0.005	mg/L
Mercury	SW846-7470	0.0002	mg/L
Molybdenum	SW846-6010B	0.05	mg/L
Nickel	EPA-200.8	0.001	mg/L
Potassium	SW846-6010B	2	mg/L

Table 2 (continued)

MET(1) - (continued)	Analytical Method¹	Detection Limit²	Units³
Selenium	EPA-200.8	0.01	mg/L
Silver	SW846-6010B	0.02	mg/L
Sodium	SW846-6010B	0.2	mg/L
Strontium	SW846-6010B	0.005	mg/L
Thallium	EPA-200.8	0.0005	mg/L
Thorium	SW846-6010B	0.2	mg/L
Uranium	EPA-200.8	0.0005	mg/L
Vanadium	SW846-6010B	0.02	mg/L
Zinc	SW846-6010B	0.05	mg/L
VOC(1) - Volatile Organic Compounds		CRQL⁴	
Acetone	SW846-8260B	10	: g/L
Acrolein	SW846-8260B	10	: g/L
Acrylonitrile	SW846-8260B	5	: g/L
Benzene	SW846-8260B	5	: g/L
Bromochloromethane	SW846-8260B	5	: g/L
Bromodichloromethane	SW846-8260B	5	: g/L
Bromoform	SW846-8260B	5	: g/L
Bromomethane	SW846-8260B	5	: g/L
2-Butanone	SW846-8260B	5	: g/L
Carbon disulfide	SW846-8260B	5	: g/L
Carbon tetrachloride	SW846-8260B	5	: g/L
Chlorobenzene	SW846-8260B	5	: g/L
Chloroethane	SW846-8260B	5	: g/L
2-Chloroethyl vinyl ether	SW846-8260B	5	: g/L
Chloroform	SW846-8260B	5	: g/L
Chloromethane	SW846-8260B	5	: g/L
Dibromochloromethane	SW846-8260B	5	: g/L
1,2-Dibromo-3-chloropropane	SW846-8260B	10	: g/L
1,2-Dibromoethane	SW846-8260B	5	: g/L
Dibromomethane	SW846-8260B	5	: g/L
1,2-Dichlorobenzene	SW846-8260B	5	: g/L
1,4-Dichlorobenzene	SW846-8260B	5	: g/L
1,4-Dichloro-2-butene	SW846-8260B	5	: g/L
trans-1,4-Dichloro-2-butene	SW846-8260B	5	: g/L
Dichlorodifluoromethane	SW846-8260B	5	: g/L
1,1-Dichloroethane	SW846-8260B	5	: g/L
1,2-Dichloroethane	SW846-8260B	5	: g/L
1,1-Dichloroethene	SW846-8260B	5	: g/L
cis-1,2-Dichloroethene	SW846-8260B	5	: g/L
trans-1,2-Dichloroethene	SW846-8260B	5	: g/L
1,2-Dichloropropane	SW846-8260B	5	: g/L

Table 2 (continued)

VOC(1) - (continued)	Analytical Method¹	CROL⁴	Units³
cis-1,3-Dichloropropene	SW846-8260B	5	: g/L
trans-1,3-Dichloropropene	SW846-8260B	5	: g/L
Dimethylbenzene	SW846-8260B	5	: g/L
Ethanol	SW846-8260B	200	: g/L
Ethylbenzene	SW846-8260B	5	: g/L
Ethyl methacrylate	SW846-8260B	5	: g/L
2-Hexanone	SW846-8260B	5	: g/L
Iodomethane	SW846-8260B	5	: g/L
4-Methyl-2-pentanone	SW846-8260B	5	: g/L
Methylene chloride	SW846-8260B	5	: g/L
Styrene	SW846-8260B	5	: g/L
1,1,1,2-Tetrachloroethane	SW846-8260B	5	: g/L
1,1,2,2-Tetrachloroethane	SW846-8260B	5	: g/L
Tetrachloroethene	SW846-8260B	5	: g/L
Toluene	SW846-8260B	5	: g/L
1,1,1-Trichloroethane	SW846-8260B	5	: g/L
1,1,2-Trichloroethane	SW846-8260B	5	: g/L
Trichloroethene	SW846-8260B	5	: g/L
Trichlorofluoromethane	SW846-8260B	5	: g/L
1,2,3-Trichloropropane	SW846-8260B	10	: g/L
Vinyl acetate	SW846-8260B	10	: g/L
Vinyl chloride	SW846-8260B	2	: g/L
Radiological Analytes		Target MDA⁵	
RAD(1) Gross Alpha Activity	EPA-900.0	3.5	pCi/L
RAD(1) Gross Beta Activity	EPA-900.0	7.0	pCi/L
RAD(2) Strontium-89/90	EPA-905.0	4.0	pCi/L
RAD(2), RAD(12) Technetium-99	ACD-TP-160074	10	pCi/L
RAD(2) Tritium	EPA-906.0	300	pCi/L
RAD(3) Uranium-234, 235, & 238	ACO-TP-7226	0.4	pCi/L
RAD(4) Americium-241	ACO-TP-7226	0.4	pCi/L
RAD(4) Iodine-129	EPA-901.1	3.0	pCi/L
RAD(4) Neptunium-237	Y/P65-7206	0.4	pCi/L
RAD(4) Plutonium-238 & 239/240	ACO-TP-7226	0.4	pCi/L
RAD(5) Radium-223/224/226	EPA-903.0 - 904.0	0.5	pCi/L
RAD(8) Thorium-228,230,232, & 234	Y/P65-7206	0.4	pCi/L
RAD(13) Total Uranium and weight % U-235	Y/P65-8044	0.002	mg/L

Table 2 (continued)

Notes:

- 1 Analytical/field methods/procedures from:
 - ! Y-12 Plant System Operation Procedures (LMES 1999c and 1999d)
 - ! *Test Methods for Evaluating Solid Waste Physical/Chemical Methods* (U.S. Environmental Protection Agency 1996)
 - ! *Methods for Chemical Analysis of Water and Wastes* (U.S. Environmental Protection Agency 1983)
 - ! Lockheed Martin Energy Systems ACO Control Procedures: SESD-TP-8204 (R.2), ACD-TP-160074, ACO-TP-7226, Y/P65-7206 and Y/P65-8044
- 2 NA - not applicable
- 3
 - ft - feet
 - : g/L - micrograms per liter
 - : mho/cm - micromhos per centimeter
 - mg/L - milligrams per liter
 - mV - millivolts
 - NTU - nephelometric turbidity units
 - ppm - parts per million
 - pCi/L - picoCuries per liter
- 4 CRQL - contract-required quantitation limit
- 5 MDA - minimum detectable activity. The target MDA may be obtained under optimal analytical conditions; actual MDAs are sample-specific and may vary significantly from the target value.

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